



ACHIM SZEPANSKI 2022-03-16

THOMAS NAILS “THEORY OF THE OBJECT”

PHILOFICTION BOHR, COSMOS, FLOW, KINETIC, MATTER, NON-LARUELLE, OBJECT,
PARTICLE, QUANTUM PHYSICS, ROVELLI, WAVE

The new book by Thomas Nail “Theory of the Object” brings on the one hand more clarity to the question of the relation between continuous matter flow, as conceived in his book “Being and Motion”, and discrete objects/particles, on the other hand Nail also raises important questions concerning the status of quantum theory. I will also discuss the book primarily in relation to the quantum theories of Rovelli, Görnitz, Barad, and Laruelle.

The indeterminacy of quantum fluctuation shows that there are no static essences, forms or substances in nature. Similar to Karen Barad, Nail speaks of an observer-dependent science that makes visible the hidden processes at play in the creation of objects. For Barad, material phenomena are not merely the result of laboratory exercises, but are produced through complex intractions of multiple material-discursive practices, that is, complex agentive intraactions of a multiplicity of material-discursive apparatuses of bodily production, where apparatuses are not merely instruments of observation, but boundary-pulling practices or particular material (re)configurations of the world that become matter.

For Nail's historical ontology, all kinds of objects, whether living or inorganic, are metastable formations of matter in motion, and this is in contrast to Western science and mathematics, which tend to conceptualize objects as discrete and stable.

Statiachen theories present themselves as either theories of objectivism or constructivism. In objectivism, a stable, static, and self-contained object is imagined to exist prior to any discovery by humans. In an extreme form, this theory assumes that nature consists of geometric and unchanging mathematical forms that do not change even when humans discover them.

Constuctivism, on the other hand, posits the object as the fixed mental stage of an observer. Whatever the object may be, we have access to it only through our thought, language, and actions.

Both realists and constructivists assume that scientific knowledge in all its representational forms as concepts, images, etc., determines our access to the material world. They differ only on the question of referent, on whether knowledge represents things in the world as they really are, or whether objects are the product of social constructions; both groups remain in the mode of representation.

Currently, there are two alternatives to the more static theories of the subject or dwa object, namely the distinction between relations and objects.

The first theory is that of relational ontology, for which the object is nothing more than the set of its relations to other objects. Nail mentions here in particular Bruno Latour's actor-network theory, for which the relation is primary and objects emerge as nodes of pre-existing networks. However, Nail could also have mentioned quantum physicist Carlo Rovelli, for whom the properties of objects are nothing more than interactions with other objects. Rovelli, echoing the Buddhist Nagaryuna, speaks here of an empty structure whose emptiness is in turn empty – it has nothing substantial about it, but is characterized by an abundance of relations. The objects do not possess an autonomous reality, rather they exist only thanks to, dependent on and from the point of view of other objects with which they interact. Relational structures neither precede nor do not precede objects, neither one nor the other, according to Nagaryuna. For him, one must forget autonomous substances or objects. Rovelli writes in his book "The Order of Time": "The fields manifest themselves in granular form: elementary particles, photons, and quanta of gravity—or rather "quanta of space." These Representation of the web of elementary grains of space (or spin network). elementary grains do not exist immersed in space; rather, they themselves form that

space. The spatiality of the world consists of the web of their interactions. They do not dwell in time: they interact incessantly with each other, and indeed exist only in terms of these incessant interactions. And this interaction is the happening of the world: it is the minimum elementary form of time that is neither directional nor linear. Nor does it have the curved and smooth geometry studied by Einstein. It is a reciprocal interaction in which quanta manifest themselves in the interaction, in relation to what they interact with."

Another direction is represented by the new vitalistic materialism, which shows relations as vital and virtual forces that allow changes in relations without causing material changes in objects.

This is contrasted with object-oriented ontology, which also assumes that objects connect in changing relations of networks, but here objects cannot be reduced to their relations, rather they are discrete and stable things-in-itself with definite boundaries. In Harman, each thing is self-contained and vacuum-packed. There is a hidden reserve in objects that is responsible for connections occurring at all.

Nail's kinetic theory of the object, on the other hand, assumes that objects are metastable formations. While small motions allow objects to remain reasonably stable, large motions can cause dramatic changes or turbulence in objects. It is necessary to overcome the idea that objects could be passive entities, ignoring relations, agents and their histories, thus making objects incapable of connections. Likewise, it is necessary to reject that they depend purely on human interventions, because then they would not be capable of emergence and change. While the relational theories completely determine the object by their pre-existence, so that there is no movement of the objects themselves, the OOO makes the essence of the objects the source of change and is thus to be understood as a theory of immobility and static transformation. Nail's theory of kinetic materialism, on the other hand, starts with the historical thesis that everything is in motion: matter or energy is, at the smallest level, an indeterminate fluctuation that is in no way to be understood as a particle, object, or substance. Motion and relation are non-determined. In a measurement on an unknown atom, for example, the most one can do before the measurement is to give probabilities for what value one can find with what probability. This is called the "quantum theoretical indeterminacy": the result of the measurement is not determined now. (See Görnitz)

With Karen Barad, Nail assumes that objects exist within fluctuating fields insofar as they are themselves metastable fields. Energy and matter are not substances and have no fixed properties. Nail begins with the historical discovery that there is quantum flux and from this a theory of metastable objects can be developed. The object itself is a kinetic process, it is thrown into motion and comes into existence when it loops in on itself. It is the fold of a continuous process in/which it loops into itself again and again.

In the first chapter, Nail reiterates his theses on flow, matter, and pederis as developed in his book *Being and Motion*. In the second chapter, he develops the thesis that objects are flows that fold into stable patterns as something moves away from the flow and returns, i.e. loops, and this can also be measured in terms of number and quantitative dimension. This is about how much or

the size of the objects that are in space and time. And this concerns not only the natural numbers 1,2,3 etc., but the fundamental structure of the size. For kinetic theory, this is an emergent dimension of reality. The quantity of an object depends on how the flow of matter circles and repeats.

In this context, Nail opposes Platonic positions that assume an idea in number.ⁱ Plato claims that the ideas inherent in language are, in the thinking process are superimposed by the rule of number. The logos is thus subjugated to the calculating ratio. In his later work, Plato assumes that all ideas are ultimately numbers. Nail, on the other hand, claims that without the capacity to sensually perceive a quantity, there can be no number. This is the sensory capacity to perceive differences with respect to size. All objects have a size that is measured relative to other sizes. But there is no size without the qualitative sensation.

The theory of size is ever already a science of measurement, which presupposes the existence in nature of qualitatively and quantitatively different objects that are folded. Nature is always composed of oscillating and vibrating matter, which can be counted when it oscillates back and forth, when it forms into cycles or identical intervals. These intervals produce a magnitude of duration and extension. The flows of matter count themselves each time they oscillate and therefore are not to be understood as exclusive mental states. Nail compares the fold that leads to the metastable state of the object to the storm of a spiral. The fold must always be understood as fold-in-motion, as repetition with a difference. Everything repeats, but always slightly differently, writes Deleuze.

The region in which flow moves with itself is what Nail calls "period," while the circle requires the time and space in which the fold returns to itself. For Nail, objects are not strictly identical to themselves; rather, as metastable formations, they are always differential in their iterations. Circles here act more like attractors, and indeed as a region in which motion occurs in frequency. Consider the Lorenz attractor, which is not a discrete block but consists of streams that overlap in time. In quantum physics, contrary to the common assumption that all quantum processes are random, it has long been discovered that entangled particles also always return to their initial positions. Because objects continuously receive motion from outside and also lose it again when passing through them, they do not have completely fixed periods.

When a circle reproduces the unity of all overlapping circles in a period, Nail calls this a "numbering". The quantity is always just a quantity that measures quantities, i.e., a singular but differential circle. Every counting has at least three performative dimensions, namely the counted, the counted, and the number. There is always here around the process of multiplication and manifesting; series of material processes of folding and and unfolding in counting. Counting is therefore always performative and never simply given.

The quantities and qualities that all objects possess are two inseparable dimensions of the same movement of matter. Here, the quality is the period in which the flow of matter affixes itself, while the quantity is the circle in which the flow complements itself in the loop. Current physics accepts both the qualitative flux of matter in quantum fields and the quantization of these fields

at different levels. Quantity is the kinetic circle of matter-in-motion and this is thought as unity or as one.

Conjunction is an ensemble of objects where different folds loop together – in a compositional factory, and this is what Nail calls a "thing", for example a table. Things are also metastable processes, created by ongoing movements that pass through them. Unstable situations occur continually and in innumerable numbers especially at all levels of organization of a living thing, and therefore it is essential to consider the action of quanta here also.

Thus also living organisms are always only relatively stable pools or fold themselves in a continuous flow, whereby they always undergo energetic transformations. Quite similarly, quantum physicist Görnitz refers to living organisms as unstable systems. Görnitz writes: "In unstable systems, as living beings are, there is an additional possibility of reaction, in which an energy is a necessary carrier, but not decisive for the reaction. Living beings can react in a specific way not only to energetic influences, but also to information. If the information can cause a reaction, which must not be attributed to the carrier alone, then this information has become meaningful for the living being concerned. It could even take place independently of the respective carrier. The incoming signals carry information, e.g. about the place of their origin, their strength and their frequency. This information, in turn, triggers specific information in the target locations through the special sense organs with which they are received in the living being. This is all possible because the signals themselves are designed quantum information."

Nail then summarizes again: Things emerge in kinetic processes, and the processes are not independent of the things: Here the processes of conjunction are to be understood as additive, with no singular conjunction of a substance occurring. Nail refers to metastable patterns of objects as "fields" because the patterns propagate in space and time. Fields are to be understood as fabricated surfaces with special orders and designs. The world has no predetermined structures, but consists of tendencies that lead to various orders and their resolutions. There is no given plan in the cosmos and this is called indeterminacy in quantum theory. Indeterminacy in quantum theory also means that there is always something unforeseen that makes it possible to determine further information. If information is measured, then, according to Rovelli, in the measurement some part of the information must become irrelevant, making something a fact that allows new information to be obtained.

For Nail, moreover, there must be something like a knowledge or intelligence in nature that arranges itself, among other things, in human bodies, but not only, insofar as matter is not at all passive, but is creative and active, and the human body remains a part of it. Fields are undulatory like the waves of an ocean. While objects allow matter to persist through cycling, circulatory fields allow objects to maintain their orders over time. Circulatory fields are the condition for objects to enter into metastable formations with each other.

Laruelle in his late work tried to develop a non-theory of quantum theory as a model. According to Laruelle, quantum superposition, which involves a relation or better a uni-lation, should first be thought of the waveform or rhythm (as a temporal pattern), which can be characterized by the

parameters of time, space, frequency, amplitude and just superposition. The rhythm integrates the superposition of waves and their molecular motions, where multiple undulations can overlap, cross, absorb, and thread into each other. Consider, for example, the waves on the beach, which are not entities; rather, they are currents flowing extensively in space. When two waves overlap or superpose, the amplitude of the resulting wave (which is neither a synthesis of the two waves nor a "new" wave) is a combined amplitude of the first two waves, i.e., the amplitude of the second wave is added to the first wave, and the result is a wave with combined amplitudes, the superposition of the two waves.

Unlike Nail, Laruelle assumes that the nature-knowledge division is not an ontological division, but an epistemological one. It is the concept as a regional rupture or local disturbance in qualitatively homogeneous information that provokes approaches and paths that are impossible in the absence of the epistemic rupture. For Negarastani, the attempt to understand nature without epistemic division through ontological monism alone is an appeal to mysticism. It also means that there is no ontology of the real. For Žižek, the field of ontology, the positive order of being, emerges through the subtraction of the real. The order of being and the real are mutually exclusive: The real is the immanent blockage of being that makes the order of being inconsistent. For Žižek, transcendental correlationism is right at the level of ontology: every "reality" is ontological, and is transcendently constituted by the symbolic order. The real is a gap in the order of being (reality) and a gap in the symbolic order. In the common transcendental view, there is a kind of Real in itself (like the Kantian thing-in-itself) that is then formed or "constituted" into reality by the subject, but because of the finitude of the subject, we cannot totalize reality; reality is irreducibly inconsistent.

The problem here is the implicit continuity of the line that starts from the natural line between the organism and its environment to the structure of meaning proper to the symbolic order. This is how Žižek imputes it to Barad's theory, In nature, differences make differences: there are agentic cuts that establish a difference between the series of "causes" and the series of "effects." What is missing for Žižek, however, is a short-circuit between the two series of differences, a sign that inscribes itself retroactively to the series of "effects" in the series of "causes." Faced with two heterogeneous series, two series of differences, Deleuze's dark precursor plays the role of differentiator of differences. In this way, by virtue of his own power, he puts them in an immediate relation to each other. He it is the object = x , the one that "lacks in its place" because it lacks its own identity.

We will come back to this.

Knowledge, for Nail, does not represent the world, but is part of it by enabling the iterative coordination of objects and their relations. Knowledge is intrinsic to objects and is part of their interactive stabilization. Moreover, the point is not only that knowledge practices have material consequences, but that the practices of knowledge are themselves specific material engagements involved in (re)making the world.

Movements are indeterminate processes, where the degree of a movement is relative to the

movement of a field. Everything moves in relation to other movements, and in this respect, for Nail, "fluxion" denotes the relative kinetic difference between objects that define their order in the field. At this point, Nail mentions Einstein's special theory of relativity, by which Einstein shows that space and time are in motion relative to each other. Spacetime is the totality of past and future related to any event, even that which is neither past nor future, so that it has no point in time, but has duration. As the degrees of flux increase, time slows down or space contracts, relative to a given field of coordination. Each degree of flux determines the degree of spacetime and not vice versa. Fluxion is simply a difference in the degree of motion relative to the given field, while conversely a kinetic field is the relative immobile background from which the various fluxions are measured.

Inasmuch as all matter has a duration and a magnitude, it is constantly measuring itself. The measurement is a kinetic act. For this, one needs a fluxion of the measured object, that is, the measurement always depends also on what is measured. The measurement is relational between the objects and produces a result that describes their coordination. The measuring instrument, which Karen Barad describes as an apparatus, for example, must therefore be a third object, but one that is contained in the measurement. Apparatuses are not mere instruments, such as a system of lenses that magnify and focus our attention on the object world, but rather they are material-discursive practices that help constitute the phenomena under investigation. Moreover, apparatuses do not simply recognize differences that already exist, but contribute to the production and reconfiguration of difference.

The formation of a wholeness and its existence are characterized in quantum physics by the term "entanglement. If then this wholeness is divided by an intervention – a measurement – into parts, the properties of these parts or their states will be correlated with each other, because they had formed a unity before. With it, a factual state of a quantum system is to be obtained. The concept of measurement is often associated exclusively with devices and apparatus. However, it is important to understand that it can also mean that an abundance of quantum possibilities is transformed into a fact by a loss of information at the system in question.

In quantum theory, for Görnitz, the determined development concerns only the possibilities. The "randomness" in the framework of the quantum theory results in the facts which are found in a measurement at the system. The Schrödinger equation shows, not everything is possible, the possibilities are subject to laws in their development, on the other hand, not everything is determined either, the concrete facts arise randomly within their possibilities. Görnitz writes: "If, however, a measurement is made, the quantum system is thereby forced to select from the possibilities only those which correspond to a meaningful answer to the measurement request. These are then, as a rule, only a discrete selection from the previous continuum of possibilities, which then leads to the "quantum leap". At the same time, this makes it clear that, depending on the chosen question, only certain answer states can appear as measurement results. Since every measurement is an action, it is evident that a permutation of the order of different measurements will lead to different results. Since not all possibilities can be realized and with the measurement result the system has entered a new state, it follows immediately that different measurements on

the same system will give very different results depending on their order.

Such "non-interchangeability" in the order of actions is familiar to us from everyday life. For physicists, however, it meant a big surprise. Classical physics assumes that everything that can be measured could in principle be measured at once, i.e. simultaneously. Therefore, an order of measurements should not matter. The astonishment about the "non-interchangeability in physics" is therefore based on the misunderstanding not to understand a measurement as an action which also leaves an effect on what is measured. It is explained by the false hypothesis of classical physics that any action could in principle be made arbitrarily small."

Bohr's argument for the indeterminacy of measurement interactions is based on his insight that terms are defined by the circumstances necessary for their measurement. That is, theoretical terms have no ideal character; they are specific physical arrangements. For Barad, they must be understood in the context of phenomena, which are precisely not merely the result of laboratory exercises performed by subjects, but are differential patterns of matter produced by complex agentive intraactions of a variety of material-discursive practices or apparatuses of bodily production, where apparatuses are not merely instruments of observation but boundary-pulling practices-special material (re)configurations of the world. For Bohr, measurement and description (the material and the discursive) are mutually dependent, not only in the weak sense of operationalism, but in the sense of their mutual ontological and epistemological implication. A different status is ascribed to the discursive here than in Nail. Bohr argues that concepts such as "position" and "momentum" are specifically embodied, and mutually exclusive experimental setups must be applied simultaneously to achieve all the necessary features of measurement interaction and interaction.

If reality is objectively "out there" and we approach it endlessly, then observers are not part of that reality but stand somewhere outside it. Within the entangled unity of a phenomenon, however, there is no clear a priori way to distinguish between the agency of observation and the observed object: Any such distinction depends on a contingent agentive cut within the unity of a phenomenon, a cut that is not merely a "subjective" mental decision, but is "constructed, agentially accomplished, materially conditioned". (Barad)

In this context, Karen Barad notes that the fact that h (Planck's constant) is small relative to the mass of large objects does not mean that Bohr's findings apply only to microscopic objects. Rather, it means that the effects of the essential discontinuity are less for relatively large objects, but they are not zero. There is no evidence to support the assumption that the physical world is divided into two separate realms, each with its own physical laws: a microscopic realm governed by the laws of quantum physics, and a macroscopic realm governed by the laws of Newtonian physics. In fact, quantum mechanics is the most successful and accurate theory in the history of physics. It explains phenomena in a range of twenty-five orders of magnitude, from the smallest particles of matter to large objects. Quantum theory, Barad says, not only complements Newtonian physics, it replaces it.

Back to Nail. For Nail, observation is also a kinetic act that coordinates the objects that have it in

the field. Each object observes other objects in the same field in which it afflicts them. The human observer is also included as a subject in the kinetic intracation. This is consistent with Bohr in that the indeterminacy of the measurement interaction is of great importance. Since observations are an indeterminable discontinuous interaction, there is in principle no clear way to distinguish between the "object" and the "kinds of observation". There is no inherent Cartesian subject-object distinction.

In Zizek's understanding of quantum physics, in turn, the observer is not immanent to the observed

in the sense that he is inscribed in it, but in the more elementary sense that his act of observation is constitutive of what is observed. Moreover, this observer is the subject of science, the subject for whom reality is "flat," for whom there is no blind spot in reality from which the object returns the gaze. Bohr's solution to the ontological status of complementarity (wave or particle) is that the microscopic system, the atom, does not exist in and of itself. We must always include the various macroscopic experimental apparatuses used to represent the two complementary aspects.

Quantum revolution privileges the wave within dwa wave-particle duality. For example, it proposes to understand waves not as interactions between particles and particles as nodes in the interaction of waves. Thus, for quantum physics, waves cannot be reduced to a property of something that happens to particles. This is also the reason why Bohr claims that quantum physics deals with (measurement) phenomena, not with things "behind" the phenomena: The whole traditional problem of distinguishing between properties that belong to "things in themselves" and properties that "seem" to belong to things merely because of our perceptual apparatus is thus undermined: this distinction between primary and secondary properties no longer makes sense, because the way a thing "appears", the way it is "to the other", is inscribed "in itself". The conception of "objective" things is subjective, dependent on perception, while the wave vibrations precede perception and are therefore more "objective".

Nail, of course, also wants to write a history of the objects. Let us now turn to this. Very generally, Nail understands science to be the creation and ordering of objects as quantities, but inseparable from the quality of the objects. Among the sciences, however, a position has emerged as if it were possible to treat particular objects merely as quantities.

The "as-if" has a long history in the philosophy of science: in this context, for example, the Marxist relation of the concepts of capital and value is to be understood, but here the non-quantitative value is interpreted in the mode of the "as-if" in the course of Marx's value-form analysis, as if the conceptual actually fell into one with the object. Thus, the concept of real abstraction finds its justification at best in the mode of "as-if". It was Kant who, with respect to regulative ideas, took the standpoint of the "as-if" view, which he finally called the "highest" standpoint of reason. Where concepts do not apply to reality in the form in which we can only think them, there it seems not only possible, but also urgently required for theoretical practice, to think and investigate objects with the help of concepts "as if" they were given or determined in this way and not otherwise. The Kantian regulative law wants qua understanding that one

investigates the things in such a way, as if a systematic unity up to infinity could be found with at the same time the greatest possible heterogeneity; it is about an undeniably philosophical "as if", to which according to Derrida at least a "deconstructive ferment" is to be added, so that the rigid juxtaposition of reality and science fiction is liquefied, until the "as if" touches on the perhaps occurring and nevertheless concrete event. Nevertheless, it must never be suppressed that the act of conceptual grasping of the real presupposes the difference between the concept and the extra-conceptual, but the cognition does not set the difference. Accordingly, concepts have to acknowledge that a reality is presupposed independently of the choice of its means ("there is"); on the other hand, in their self-reference and self-similarity, they work, among other things, with a heuristic of "as-if", as if reality and concept would actually coincide. Barad, on the other hand, attempts to overcome the "as-if" in her agential realism by means of the construction of intraactive discursive, material practices.

For Nail, the history of objects begins with the ordinal object that existed in the Paleolithic phase of human history. When objects were counted, it was not just a matter of counting with the natural numbers 1,2,3, etc.; rather, for a long time in human history, only ordinal objects were counted sequentially, in the sense of "and then, and then, and then, etc." Although ordinal number was first introduced by Cantor, it existed in prehistoric times, as centripetal motion, sequence, and one-to-one coordination. The former is the continuous movement from the periphery to the center. The ordering of these objects according to their destination occurs in the context of other objects and requires a relatively stable center to support this ordering. If the center changes faster than the order of the objects, then this order decays, whereby this order is just not given, but is developed by the centripetal movement.

This movement takes place in temporal (before and after) and spatial (more or less) sequences qua differences. Thereby the first object is that of a relatively stable center, which means nothing else than that the non-sequence is the precondition for the sequence. And insofar as each following object is larger than the initial object, the latter retroactively becomes smaller in relation to the present addition. In this respect, sequences create a constant imbalance relative to positions. Each new addition within a series changes the relative position of every other object, or, to put it another way, each ordinal object transforms the whole series. Each object is thus not a cardinal number 1,2,3 etc., but the dimension of an immanent order. Thus, people counted the rivers of water not as isolated individual objects, but as transformative dimensions of the relative volume of water. Finally, one-to-one coordination is not a representation but the result of a kinetic cycle. An ordinal object is not a unit that can be divided into other units; rather, the position of an object in a sequence cannot change without changing the whole series.

For Nail, tools are also ordinal objects, created by centripetal patterns of motion. The tool is not a singular object, but an ordered series of objects, or, to put it another way, a sequential chain of objects. The mobile body is already a kind of object, insofar as there is no clear separation of user and tool, but only a relative difference that depends on one's position in the sequential chain. An instrumental perspective must also be rejected here, insofar as the entire field of tool-objects must be considered. Nail ultimately defines the tool as a series of ordinal objects in

which the objects interact and cooperate. This metastable circulation of objects, which are never static and discrete, includes the material, the designer, and the process of design. Like Deleuze/Guattari, Nail refers here to the anthropologist Leroi-Gourhan.

Signs, in turn, are for Nail ordered series of centripetal assorted markings. In early times, signs are less to be understood as representations of something than as traces left behind that refer to rhythmic ordinal sequences of bodily movements. Sound and markings always took place one-to-one, with each sign being singular, changeable, and performative.

Cardinal objects, in turn, which were also historical inventions, are treated by us as if they had no qualities. It was numbers, geometric measurement and logic that created the field of cardinal objects. The mathematician Georg Cantor defined the cardinal numbers as aggregates of a series of elements that lead to a whole. It was in Mesopotamia in 3500 B.C. that the numerals we know today as 1,2,3, etc. were invented. They are not the same as the numbers that Nail defines more generally as a quantity, whatever it may be. This also runs counter to the common definition of Carl Gauss, that numbers are fundamentally cardinal and ideal entities. The theory of number entities is like a building of marvelous beauty and harmony, Hilbert writes. The addition or subtraction of numbers presupposes that the numbers are only multiples of an empty unit. But this very unity remains a mere presupposition, an axiom, for mathematics. When Dedekind introduces unity as a basic concept in algebra, this category is defined autologically Frege writes: "It is actually a scandal that science is still unclear about the essence of number. Whether it is something mental, about the origin of which psychology must give information, or whether it is a logical entity, whether it is created and can pass away, or whether it is eternal, even about this science has not yet decided anything. Is this not a scandal?" What actually is a number, one must ask. For Plato, it was an a priori construction, insofar as, as Frege later thinks, mathematical structures form a third alongside subject and object. The intuitionist Brouwer regarded mathematics as a product of pure thought, while another direction describes mathematical entities as fictions.

Werner Hamacher offers a non-solution: "One, and therefore every other number (with the problematic exception of zero), proves to be a marker by the fact that it cannot count itself, which neither satisfies the concept of number nor that of marker, insofar as this concept postulates unity and existence. By the fact that the one cannot be counted by itself, not only the uncertainty of the object of the number is shown, but also its inexistence as number: There is no number one, which could be counted by the number one; one is not. (The same is true of all numbers, because all must operate with the one or a corresponding numerical or nominal unit). The compelling conclusion from this finding is that the number itself is numberless, uncountable, thus in a strict sense infinite and non-being. If numbers are nevertheless operable, then only under the condition that each counts without being counted. A number counts only as far as it is pure setting and thus not founded in its applicability or self-applicability. Its operations can be based only on the counting function, not on a substance of number."

And this counting function can only be the social of a money for Karl-Heinz Brodbeck, for example.

Nail writes that the cardinal object that counts is not contained in the one (sum) that counts it. The paradox is that when counting the parts of a series, one assumes that they are already parts of a whole. Ultimately, the cardinal object, is the first, the last, and the missing. The idea of zero is also based on this.

If the cardinal object can refer to the One, whatever, then it has no particularity, substance or quality. It is as if this One pre-exists and remains immutable, and as a real-abstraction.

For Nail, the cardinal is not a purely mathematical idea, but a historical pattern of movement that forces things into abstract unities. Cardinal objects are abstract, but they are precisely to be understood as historical abstractions and material-kinetic processes. They create a model (not substances) for counting and measuring objects as wholes.

Cardinal objects are the result of centrifugal movements that spread out in all directions from a central point. This point again presupposes the centripetal movement from the periphery to the center and an ordinal series of objects, with which first central points can arise. Only when the object of an ordinal series is designated as cardinal, can this cardinal object then be used as a tool to measure and unify a variation of heterogeneous objects as if they were parts of a pre-existent whole.

Concrete cardinality is what Nail calls the unification of ordinal objects into a singular cardinal object; these are particular kinds of groups. They are still qualified quantities. For Nail, there are three concrete steps and one abstract step leading to the abstract cardinal object. Ordinal series are always in motion and in them the relative positions change in a continuous disequilibrium, while cardinal objects must make a cut at some point in order to count collected objects as one thing. Moreover, a sharp difference must be set between inside and outside to create a ranking of more or less. The objects in the center precede the objects in the periphery. The former serve as a model to reorganize the periphery. Finally, the new homogeneous entity is treated as a new generic entity. If the cardinal object as one refers to the one of whatever, then it no longer has a quality; we are now dealing with one-to-many coordinations.

The cardinal object does not count in ordinal parts 1,2,3. but counts everything as a generic part of a whole. It is not counting that defines numbers, rather numbers are used in counting.

Hamacher takes a different view of number, see above. Cardinal objects are not representations of the objects they count. Cardinal objects are different from those they count. The cardinal whole is just another singular object kinetically coordinated by a series of other objects as if they were a whole object. The cardinal object counts all other objects in a series as one.

The cardinal object can also treat a number as a unit. Each cardinal object in a series is the copy of the original, so to speak. Here the zero is the placeholder of a generic whole. Two cardinal entities are identical if they have the same unit of elements, no matter what those elements are.

Nail then turns to cardinal objects in the ancient world. Numerals had to be invented, signs or tokens treated as if quality were separate from quantity. Finally, in general, any object could be used as a cardinal object with which to count any other object. Digits were now treated as pure

quantities. The two is now no more than just after the one, but it is a new cardinal object containing the one; Every cardinal object is proportional to the first cardinal number. The first abstract digit 1 was the central model of a unit to which all other cardinal objects were proportionally related.

While accounting adds up, counting records the order of objects. Money, in this context, is not a singular object for Nail, but a performative relationship between objects. Money is about the specificity of the circulation of objects between persons. This coincides, for example, with the statements of the Buddhist economist Karl-Heinz Brodbeck, who writes that calculating in money always happens performatively; it becomes a pure calculating to which abstractions are precisely performed performatively in everyday life. For Nail, money is a system of changing rates of exchange between cardinal objects, with money generating an equivalent of exchange between different cardinal objects. For Nail, money exists in antiquity. An abstraction is performed on the objects, wherein only what is useful is grasped, and others are excluded. As Hegel writes, "To assert abstractions in reality is to destroy reality."

No matter what material is now the carrier of money, it is always about the system of equivalence itself. Even Marx sometimes misunderstood the concept of equivalence. He writes: "The equation: '20 cubits of canvas = 1 skirt or: 20 cubits of canvas are worth 1 skirt' ". But this is not an equation, but an equivalence relation: the quantum physicist Görnitz expresses it correctly: "It must be remembered that equivalence does not mean equality, but a possible mutual transformation." Marx sometimes comes up with the erroneous idea of the equation because he assumes a substance of value that is in the canvas as well as in the skirt. At best, however, it can be said that the equals sign is consummated and has a social and performative sense in monetary transactions that appears computationally as a reference to an abstract monetary unit.

Brodbeck calls money "the form of calculating thinking in general." It is calculating in the empty, abstract unit as a model of the number one. As a multiplication of the empty unit, money has the form of the infinite series of numbers 1, 2, 3, etc., that is, an empty unit governs multiplicity. For Brodbeck, computational thinking begins with Fibonacci, who wrote one of the basic books of arithmetic in 1202. Fibonacci was the first in the West to introduce zero into the number series. He calls the series 1, 2, 3, 4, 5, 6, 7, 8, 9 "Indian figures" and writes: "With these nine figures, and with the sign 0 which the Arabs call zephir any number whatsoever is written." Arab traders brought from India the idea of "emptiness" (sunya). They translated "sunya" as "zefira", from which our "zero" and "digit" were derived. The unknown is a number derived from known numbers.

The zero allows in monetary transactions to form arbitrarily large numbers. In the zero the emptiness of the unit of the money "appears", which can be multiplied arbitrarily due to its emptiness. The zero gives the numbers only a position, it is a signpost which leads to a classification of the numbers in an infinite counting system. A number like 3 gets a higher rank through the zero: 30, 300, 3000, and so on. The zero multiplies the social fiction given in the unit of calculation and gives the digit a higher rank in validity. The one of the zero as empty unit, which is none, shifts the number row, so that the first will always already have been the second.

Arab traders brought from India the idea of "emptiness" (sunya). They translated "sunya" with "zefira", from which our "zero" and "number" was derived. The unknown is a number which is derived from known numbers. Now what is the void: the zero or the one?

On the question of interest, Nail writes historically correctly that by 2400 B.C. in Mesopotamia, the original division between the central standards of exchange and the peripherally exchanged objects had reached a clear hierarchy of creditors over debtors. In this, debts were not to be understood as those owed to a god; rather, religion followed the same centrifugal patterns of movement.

On the question of measurement, Nail shows that a unit of measurement is a cardinal object that was used to compare the quantity of one thing to another in terms of proportionality. This presupposes the kinetic division between a unit object and a set of other objects measured by that unit. The measurements of weight or length were originally only those of a more or less. The first standards of weight measurement resulted from the mobility of wheat. Later, all measurements arranged themselves around a central, cardinal object, namely the state.

Measurement was also the basis of arithmetic: however, addition was quite different from counting cardinal objects. With addition it then becomes possible to vary the unit of counting itself. Contrary to Russell and Frege, who claim that numerals are conceptual self-identities, Nail assumes that numerals are kinetic and measuring movements. Thus, in an addition, the cardinal number line is measured by differential unit-objects: $1+3+5=9$.

The most abstract cardinal object consisted in the invention of the variable in algebra, whose value and whose unit can take any x arbitrary value and any x arbitrary unit. The variable is a non-quantified and non-qualified quantity. The point here was not only the introduction of an abstract object with an unknown quantity into the arithmetic equations, but also that algebra enabled persons to act as if all determinate objects resulted from primary generic quantities. As if the world consisted purely of abstract forms, which determined persons by measurements, and just not vice versa.

Nail also identifies four movements in logic, which is by no means static.

- 1) Abduction, which uses empirical observations to draw conclusions from the movement between cause and effect. Hypotheses are added to additions of observed facts. In this process, the causative force is central and acts on the effects in the periphery. The decision to make one object the cause of another remains arbitrary.
- 2) Induction consists of the process of testing different causative objects and hierarchically ordering them with respect to one more or less possible. Inductive hypotheses are found through trial and error processes.
- 3) Classification contains a division and hierarchy of ordered and unordered objects.
- 4) Finally, deduction, which sets an original true statement from which one can then draw the necessary consequences. Because the original premise is held to be true, inferences do not

need to be proved by the effects they have in withering. Nail himself still finds the kinetic origins of deduction in the logic of Aristotle. The word hypothesis here refers to the meaning "to draw something," while inference inheres a journey. For Nail, the origins of logic do not consist in the pure ideas of the mind, but are primarily movements of measurement. A theorem is then a statement tested against pre-existing premises. The knowledge of deduction is nothing but that of categories and hierarchical relations of containment. It involves the ultimate self-reflexive tautological and circular movement of the rotation of a sphere, such as in Aristotle's cosmology. The deduction, like the centrifugal circle, insists on the identity of its cardinal whole. This leads to the identity and oneness of being.

It was Parmenides who supposedly said that thought and being are the same. i.e. thought = being. Since thinking and being appear dual, in philosophy this opposition was temporally reinterpreted as causality. This resulted in idealism, which asserts that thinking leads to being, while for materialism, being grounds thinking. Theory and facts, however, are aspects of the life-world, as Brodbeck notes, and not entities. Any induction, falsification, or deduction, even the idealist deduction in Hegel's logic implies an identity between thinking and being. For Brodbeck, it is Heidegger who correctly remarks on Parmenides that "the same" stands as a riddle word or tautology at the beginning of Parmenides' statement and does not appear as a mediation. To reduce the same to an equality is for Brodbeck "the expression of the overforming of the logos by the ratio". Identity, for Parmenides, endows the duality of thinking and being. Identity is a "riddle word" because, although it grounds all statements, it cannot itself be stated. The same is true for the number "1". Brodbeck writes: "The identity borrows performatively its meaning from the socialization, the unification of the and of the many.... One cannot "explain," "derive," or "define" identity. All this already takes place in an identity, a Ver-unifying. The identity comes to the things and thoughts, but cannot be found in them. The theorem of identity, as it is formulated in logic, is: $A = A$. One can write the theorem of identity also changed like this: $A \text{ is } A$. Now it is spoken of a being of A . The ratio sees in the horizon of the abstracted money everywhere only the same, i.e. something, which in turn is referred to an empty unit (the unit of the money calculation): One assigns a number to a something, makes a thing, which merely "is", measured in. The identity becomes here completely under the rule of the ratio of the equalization of all phenomena in the light of "the one of the number" to an illusory form the unit of the money, in which is calculated." An illusion, however, only insofar as there is nothing behind the unit of account of money but the social context. When one speaks of functions of money, it does not have them, but money is sui generis a social function. Illusory in the sense of a necessary inversion, however, also that this equation or equation is actually an equivalence relation. Money converts all commodities into money, and all commodities are converted into money, although money is not commodities, and commodities are not money.

This is also addressed by Hans-Joachim Lenger, who points out that already the proposition of identity $A=A$ points to a third, to a difference that precedes the equation, insofar as A has already doubled itself before in $A=A$ and therefore as the first A is at the same time a third, so that identity emerges from the repetition of difference. A is not simply identical with itself, but will have been identical with itself via a detour, with which A as origin or as first is ever already

deleted. We have to do here again with a "there is", which is to be understood as difference to positivity, which however takes place in positivity itself. And this difference already touches the non-representational and thus the value.

Laruelle has a completely different approach to the One: The One is the Real, i.e. in the Real the One persists independently of philosophy and of being. For Laruelle, the One is radically immanent, it is not convertible with anything, that is, it does not go out of itself to enter into a relation with something. But it also cannot be equated with existence, it is neither being nor being. In its immanence, Laruelle understands the One as identity. It is given-without-given and thus identity or commonality with itself without ever being fully transcendently constructed. All transcendentals are to be understood as clones of the One or of the immanent Real. Thus, the One is also the result of a weak transcendental positing; it is given-without-given and at the same time defined as a negative possibility that stands for all "tangibility" of objects and for the rigor of thought itself. Laruelle rejects out of hand the metaphysical philosophical models that work with concepts such as representation, manifestation, or existence. For Laruelle, the One is never that which can be realized in being. The One simply refuses to be a synonym for being. Rather, it is to be construed as an a priori condition that indicates radical immanence, that is, that identifies the One as non-manifest and non-reflective. From the perspective of the object, the One is not a thing; from the perspective of the relation, it does not form relations; from the perspective of the event, it does not occur and it does not actualize. Laruel objects, according to Galloway, are black objects without windows, and his preferred relation is unilateral determination, which is irreversible and non-reflective, it is not to be classified as classificatory or differential as in empiricism, for example, nor is it combinatory and synthetic as in dialectics, neither is it considered efficient or event-like as in metaphysics.

We skip the sections on relativity, digital logic and transcendental mathematics (Riemann, non-Euclidean geometry and set theory) and go directly to the chapter on contemporary objects. These are, first, loop objects treated in quantum theory, category theory, and chaos theory, as folded, iterated, and metastable objects. The conditions by which these objects arise are processes. They are hybrid objects in that they are embedded in a theoretical framework that applies to all kinds of earlier objects that are now being reinterpreted. The Loop object is the metastable result of an indeterminate process. Unlike all earlier objects, the Loop object is treated from the outset not as static and discrete, but as an emergent property of processes. Things no longer appear as actualizations of fixed degrees of possible objects. Loop objects are neither probable nor determinate, but sui generis metastable stages of indeterminate processes. They are relational and shaped by feedback processes. When material processes affix themselves, they form loops. The metastable self-identity of the object is the result of continuous feedback with itself and other objects. Objects and their relations are here co-emergent phenomena.

Nail assumes that nature can be understood neither by determinism nor by randomness, but only by relational indeterminacy. To this extent, this agrees with Carlo Rovelli, who conceives of relationality and indeterminism as two of the three essential principles of quantum theory.

However, for Rovelli, granularity is the third principle. For him, space is discrete and not continuous. Every field consists of quanta, which have a fine-grained structure. However, in the fundamental equations of quantum theory, there is neither space as a continuum containing things, nor time in the course of which phenomena take place.

Indeterminism brings Rovelli together with probability, chance at the atomic level. In quantum mechanics, one can only calculate the probability with which an event occurs. And the calculated values are those that a variable can assume at the moment when one object interacts with another (relationality). With Dirac, one can calculate the probability with which a variable takes on this or that value when an object interacts. Rovelli's indeterminism shows that there are no definite predictions, only probable ones. And a photon appears at a particular location only when it collides with another, and this cannot be predicted with certainty. Like Nail, Rovelli here quotes the Greek Lucretius, who speaks of deflection occurring at an uncertain time and place. One considers all the paths that an electron can take between A and B, but for each course there is just a finite number of possibilities, the sum of which makes it possible to determine probabilities. The electron is treated as if it would pass through all orbits on its way from A to B and would dissolve into a cloud and mysteriously approach B, with which it then collides. We return to the "as if" below.

Nail, unlike Rovelli, does not speak of granularity or graininess, but of continuous flow as the most important principle of matter, and again mentions that objects could never be perfectly discrete. Moreover, his indeterminism is not one of probability, but to be understood ontologically. Also for Dirac, position, velocity, momentum, and electric potentials are only possible if one considers the relation of objects with other objects. This is what Nail calls a fully relativistic quantum theory for quanta-in-transition. For Dirac, a quantum field behaves like a vibrating string whose frequencies first lead to the formation of particles or to certain levels of energy. Also Rovelli speaks of the interaction of things, which does not say where a particle is, but where it can be seen from others. It is about the how of a mutual influence. All characteristics of an object exist only in relation to other objects. There is no reality without the relations of objects to each other, that is, things emerge from relations. Here Rovelli is close to Nail, who, however, still emphasizes movement more strongly. In the end, even for Rovelli, quantum theory is less about objects and more about elementary events. An object is only a monotonous process which repeats itself constantly for a while, i.e. loops. Nevertheless, granularity remains essential for Rovelli, insofar as information present in the state of a system is finite and limited by Planck's constant. Nail later tries to contradict this. We will come back to this.

The notion of pedesis is important to Nail in the context of quantum field theory. These have indeterminate vibrations called vacuum fluctuations, which are neither in one state nor in another. They are said to be virtual particles that emerge from and immediately disappear into the vacuum; they cannot be "made". However, their influence is measurable. In quantum field theory, the creation and annihilation of quanta is recorded. The Nobel Prize winner Richard Feynman has made clear that in this formalism also virtual photons must be considered, if e.g. the electrostatic forces between atomic nucleus and electron shell are to be treated correctly quantum

theoretically. Electrostatic force fields mediate in space the possibility to cause motions, i.e. to release kinetic energy. The photons, which they describe, exist only according to the possibility, they are virtual. Waves, on the other hand, which transport energy, are captured by real photons. All electromagnetic interactions are based on the exchange of real and virtual photons, where the real and especially the virtual photons are entangled. In the quantum process of entanglement, various quantum structures are formed into wholes through interactions with matter. Decisive in the entanglement is that in an exact description the initial objects in their original form of existence are no longer present. (Görnitz)

For Nail, however, these virtual particles are neither virtual nor are they particles, but indeterminate kinetic vibrations in the field itself. Physicists describe the motions of these fluctuations as a turbulent whirlpool and their effects on the equations of quantum theory as perturbations. For Nail, however, the fluctuations do not disturb the particles because they are nothing more than vibrations in the fields. But if the energy in the quantum fields is nothing more than a relativistic and relational process, where do the particles come from, even Nail asks. When indeterministic degrees of freedom are brought into play, the probabilistic model collapses for Nail. If one wants to get a finite answer, then one must assume possible discrete objects. Even then, the chance of a particle happening is one toward infinity. Therefore, quantum field theory, in order to get results, must treat the fields as if they possessed finite probability degrees of discrete particles moving at random. Quantum theorists co-create and stabilize an indeterminate process into an object, but the indeterminate motions never completely disappear. They are merely meta-stabilized into objects.

Rovelli himself speaks of motions of quantum fields, not particles, fields in which elementary events in spacetime take place. He writes that the world is not made of pebbles, but of vibrations and teemings. And yet Rovelli holds that the world is fundamentally granular in structure. And most importantly, the information contained in a system is finite.

Görnitz, on the other hand, has developed a theory of meaningless information whose fundamental units are qubits. A qubit is extremely nonlocal, whereas a particle is a model for something localized. To create a mathematical particle model here, one must go to infinitely many qubits. Görnitz writes: "A bit has only the states "Yes and No", a qubit has infinitely many different states. It is true that not every one of these states will be realized with the same probability, some have a large probability, others are unlikely to be obtained, but nevertheless there are an infinite number of states. If one then asks whether the state that can be represented by an arrow is present, then only two answers are possible: "yes, the state is present" or "no, it is certainly not present."

Görnitz uses the formula $3 + \infty = \infty$ and $5 + \infty = \infty$ for clarification. This is a completely different addition structure than finite numbers, but it can be seen. By the infinity the finite sizes become negligible. From the beginning of the universe, the qubits turn out to be a "substance" with a quantum structure for Görnitz. He calls this a "protyposis", which is ontologically prior to all the various types of phenomena, but has the potential for formation. Protyposis is an informational structure that is initially meaningless. In relation to the living, it can become something

meaningful.

For Nail, vacuum should not be translated as emptiness, because in the vacuum of a quantum field there are activities, that is, continuous fluctuations. In other considerations, other infinities are postulated. Thus one hypothesis assumes that the measuring procedure is coupled to the electromagnetic field and that this possesses supra-countably infinitely many degrees of freedom. Thus, for these cases, the objects of classical physics can be represented as infinite limits of quantum structures.

Regarding the definition of feedback, Nail refers to Karen Barad’s notion of intraaction. While particles interact, fields intra-act. Bohr showed that objectivity does not require a Cartesian cut between particles; rather, it is a matter of intra-actively staging a “cut” (determined by the experimental setup) that unambiguously separates the “object” (that which causes the marking) from the observables (the effect), allowing reproducible and unambiguous measurement of some part of the phenomenon. Intraaction cannot be called an attribute of subjects or objects (since they do not exist as such). It is not an attribute at all.

For Barad, reality is one of the entangled phenomena that obey quantum laws: it is only within a phenomenon, as part of the intra-action of its components (to speak of “interaction” is already a concession to classical ontology, for it implies that separate parts somehow interact) a cut is made and the object is fixed as observed. The cut isolates the object as “cause” and the mark in the gauge as “effect,” so that a change or difference in the object is entangled with a change in the gauge. This cut is inherent in a phenomenon. What matters is the “contextuality” – the condition of possibility of the definition. Žižek has pointed to the occurrence of the transcendental notion of “condition of possibility” in his review of Barad. The apparatuses play a kind of transcendental role, structuring the field of intelligibility of a phenomenon. The possibility of measurement is here transcendently constitutive.

Every phenomenon comprises its own “past” and “future”, which are created as soon as the coordinates of this phenomenon are determined by an acting cut. This means that every phenomenon already includes an agentic cut. Thus, each phenomenon leads to a specific difference: a cut that juxtaposes an agent and an object. The background of this plurality of phenomena, is the void or vacuum, the pure quantum potentiality: each phenomenon breaks the equilibrium of the vacuum. If it is already difficult to imagine that a small part of reality arises from nothing, how can the whole universe arise ex nihilo? Of course, no single object within a given universe can come into being from aNothing, but the entire universe can do so.

Agency here means the “doing” or “being” in its intra-activity. It is the enactment of iterative changes to particular practices – iterative reconfigurations of topological manifolds of space-time-matter relations – through the dynamics of intra-activity. Agency is about the possibilities of change afforded by the reconfiguration of material-discursive apparatuses of bodily production, including the boundary articulations and exclusions marked by these practices in the production

of a causal structure.

Intra-actions are non-arbitrary, non-deterministic causal actions through which matter is iteratively transformed into its ongoing differential materialization in the process of becoming. Such dynamics is not characterized by an external parameter called time, nor does it take place in a container called space. Rather, iterative intra-actions are the dynamics through which temporality and spatiality are generated in the materialization of phenomena. Material-discursive boundaries and their exclusions are constitutive elements of the dynamic interplay (intra-play) of determinacy and indeterminacy. Indeterminacy is never resolved once and for all. Exclusions constitute an open space of action; they are the changing conditions of the possibility of changing possibilities.

Zizek formulates objections to Barad's agential realism: the problem is not to locate concepts in material practice, but to explain how material practices can produce winw ideal entity that we understand as concepts. We are part of observed reality, the intersection between subject and object is contingently performed, but for Zizek the real problem is whether the appearance of a subject can be explained in terms of the acting intersection within the entanglement of a phenomenon. He proposes a more radical trans-phenomenal cut as a kind of transcendental a priori that only makes intra-active agential cuts possible. For this he cites the notion of parallax, the shift in perspective necessary to produce the effect of depth of the real, as if an object acquires the impenetrable density of the real only when its reality is shown to be inconsistent: The observed X is real only insofar as it is the impossible point at which two inconsistent realities intersect—now it is a wave, but when we measure it differently, it is a particle.

For Laruelle, on the other hand, quantum thought is a non-positive act rather than just a series of discontinuous algebraic operations, but a real act rather than a structure of being, an immanence rather than an uncertain transcendence. Superposition is itself superpositional, which means that it is without relation, even transcendental relation, to itself. It forms a consistent, albeit generic self, a Last Instance, rather than a derivative modality of consciousness or the autopoietic self. The superposition of states results in a thickness that incarnates rather than incorporates, a new, fully immanent state, a material rather than a materialistic spirituality. The axiom as quantum of expression ends the atomistic axiomatics of mathematics, philosophy, and theology. Instead of Zizek's parallax Laruelle puts the oraxiom. The oraxiom (conflation of axiom and oracle) indicates the superposition of the mathematical axiom and the non-philosophical decision. The "axioms" of non-philosophy or generic science conjugate two types of decision – the mathematical, to establish a formal field structure, and the non-philosophical, i.e. the undecidable decision. The oraxiom is radically immanent. Other nuances of the oraxiom such as cryptic, enigmatic, the abyssal or the groundless, the delirious, etc. belong to philo-fiction and should be transformed according to the same conditions. Future is what is demanded and performed par excellence qua oraxiom.

Görnitz actually writes something similar: "As a model for logical thinking an axiomatic structure in mathematics can serve, from which one can then derive with logical reasoning the laws valid

for it. This appears as a deterministic structure, as we know it from classical physics. Which axioms one chooses, however, is not determined by logic, that is a creative act. The conclusions from given axioms build on each other like Lego building blocks, so that then very beautiful structures can be produced with it. The choice of new axioms is then reminiscent of the structure in quantum theory, where the spaces of possible states are multiplicatively linked, so that any building block notion must fail.”

In Barad and Nail, the axiom dissolves in intraction or kinetics, although one would have to ask whether this does not set new axioms again.

One can visualize the immanent feedback relations in quantum fields in loops, bubbles or folds. At this point, Nail himself quotes Rovelli, who writes that it is the relations and relational processes that ground things.

Nail himself speaks of a kinetic operator when it comes to analyzing the indeterminate motions that lead to the formation of kinetic quantum objects. When quantum fields vibrate and interact, they create space and time. Using the equations of loop quantum gravity, one can model energies down to the lowest quantifiable level of Planck length. Below Planck length, the energy fluctuations, if observed, would be so indeterminate that the required energy of the photons would be so great that they would create a black hole. Therefore, Rovelli describes the Planck length as the natural limit of quantum theory. For Rovelli there is nothing below the Planck length and therefore space is made of atom with the size of Planck units. But for Nail there is energy also below these units, but it becomes so radically indeterminate that the laws of physicists fail.

So for Rovelli, relational ontology comes to an abrupt end at the Planck scale. Below the Planck scale, Rovelli argues, there is simply “nothing,” and so spacetime consists essentially of discrete “atoms” or “grains” whose possible sizes have discrete Planck units. Even though everything, including spacetime, manifests relationally, for Rovelli these manifestations still obey predetermined and changing probability distributions that are ultimately rooted in (Planck-based) possibilities – however numerous they may be. The problem is that Rovelli treats the Planck scale as if it were an absolute, pre-existing basis for an invariant mathematical formalism that humans simply discovered, rather than, as Nail argues, an active zone of generative, experimental indeterminacy.

Nail claims that there can be no absolute, pre-existing boundary of material reality that remains unchanged or unaffected independently of our observations. The notion of vacuum fluctuations in quantum field theory is a means of rethinking the “void” as a spectacularly alive and creative place. Karen Barad has viewed these quantum fluctuations as a vivid dramatization of the inherent and creative ontological indeterminacy of matter. Here, the indeterminacy of matter precedes all measures of reality.

Nail wants to think beyond this to a generative or performative new materialist explanation of spacetime and black holes. But even an omniscient being with infinite knowledge would not be able to exhaustively quantify matter because it is inherently indeterminate, generative, and relational. The belief that matter could ever be described as a closed or bounded system with a

limited range of possibilities that obeys invariant laws therefore seems to be an illusion.

Nail believes that black holes provide the historical basis for a new theory of materialism in which matter is no longer passive, negative, or even probabilistic. This new performative materialism is characterized by three core features:

1) If virtual, micro-black holes index the primordial creativity of all matter, spacetime, and quantum fluctuations, then all matter, from the Planck scale to the macro scale, must also be defined by a "pedetic" materialism. This means that the laws of nature, including the Planck limit and probabilities, are products of a primarily indeterminate process that iteratively changes and revises over time.

2) Matter is not a continuous or discrete substance moving in spacetime; it creates spacetime. Black holes are neither passive matter nor empty voids. Looking at what is known about black holes, without leaving out the measurement problem and indeterminacy, suggests an interpretation in which matter is an endlessly fluctuating, creative process more fundamental than spacetime or the Planck scale – which must arise from these quantum processes, not from the background laws that govern them. At the bottom of a black hole, we find not the infinitesimal singularity predicted by general relativity, but indeterminately moving energy – with no further fundamental explanation.

3) The indeterminacy of a black hole points to an interpretation in which matter manifests itself relationally and immanently. Matter is not the passive or accidental object of something else that is outside of it.

In the last two chapters, Nail deals with mathematical category theory and chaos theory. The former involves a logic of continuous transformation between mathematical objects, a variety of mathematical constructivism that assumes that the existence of mathematical objects must be shown in practice in each case. Nail reiterates here that for him the grounding of any kind of mathematics does not happen independently of its kinetic construction. He mentions, among others, the mathematician Ferlando Zalamea, who shows that category theory treats all objects purely structurally and as relational networks, without reducing them to a single kind of object.

A category is a mathematical structure or group of objects connected by relations called arrows or morphisms. Anything can assume the status of an object, be it a letter, number, places or names, and any relation between them can be described (motion, space and time). The category is thus a general structure that objects and relations share. At the same time, different categories can also be coordinated with others qua relations, which are called functors. These are the relations between categories by establishing one-to-one relations and correspondence between objects and relations between different categories. Categories themselves can act as objects with well-defined systems of relations to each other via functors. Such systems of relational objects and meta-relationships between them can constitute categories in their own right.

In this context, Nail mentions the diagram, on which Rocco Gangle has provided a detailed study in his book *Diagrammatic Immanence*. Diagrams imply a partial blurring of the distinction

between meaning and notation, or between object and sign. Diagrams are essentially iconic. They are what they signify. Diagrams are always realized within an already given system of relations that serves as the environment for their inscription and selection. Diagrams are thus selected from pre-existing structures, which may be relatively abstract or more concrete, as the case may be, but which are in any case instantiated as real systems of relations that already exist in a differentiated field. Diagrams operate according to a formal reversibility between specification and evaluation, or between abstraction and selection. A diagram highlights particular relations between a local system of relations by updating new relations, precisely those that determine the diagram itself in terms of its user and its use.

With regard to the notion of *pedesis*, which is important to Nail, the latter calls category theory a "process-mathematics without any foundation." In this regard, its objects have no essence, since their existence is immanent to the construction of arrows and movements.

In the history of philosophy, the term "immanence" denotes any metaphysical position or method that rejects the notion that the ultimate structure of reality can be investigated independently of its real content. Immanence forbids unilateral arrows from metaphysics to ontology or from logical grammar to real semantics. Positively put, immanence prescribes a universally self-modeling structure or global plasticity. Moreover, it posits an ultimate chiasmus without remainder, without externality. Any such metaphysical view implies a generalized relationality at the level of ontology, an ontology of relations rather than objects. If reality is ultimately structured by immanence, then ontology is inevitably limited to relations. Things must be relations all the way down (however far that may be) and without remainder. It is normally assumed that there are things or objects. It is also commonly assumed that relations depend on there being things to which they refer. But if immanence is metaphysically correct, then this normal way of thinking is wrong. "Things" in the usual sense are ultimately nothing more than relations of one kind or another, existing or not existing between other relations, and so on.

Already for Spinoza, the relations of motion and rest between the constituents of a whole taken together were the essence or "nature" of the individual in question. The manner of this communication of movements is thus a fundamental component of the individual as such. Relational structures are structures of infinite variety, which everywhere in turn enter into superordinate relationships with each other, and so on and on without end. We and all things around us are both immersed in and permeated by these kinds of relationships. We can, at any scale of inquiry, take relatively stable connections of more or less particular local relations to be "things" or "objects" in a very general sense, and we can expect to find a variety of relations connecting objects, depending on which ones we choose. Moreover, such relationships often interact in internally differentiated systems of a common type: economic, chemical, linguistic, military-strategic, stellar-galactic, and so on.

How are the elements of a category defined? An arrow is a path that leads from somewhere or something to another place or something else. It has the unity of a line and thus is a special kind of "point" that has two distinct "ends". Moreover, the two ends of the line are ordered, that is, one comes first and the other comes next. A line, in turn, is an arrow without the distinction of source

and destination. It connects its endpoints by laying a link through space. Some of its possible meanings can be explored by moving through the many contexts in which lines of various kinds are drawn. A frame distinguishes between an inside and an outside and summarizes the contents of its interior. It is like a hollow point that can perhaps be "filled" with other things, other diagrams. The meanings of a frame are at least as varied as those of all possible territorial boundaries.

Categories are satisfied by three general criteria: 1) For any two arrows f and g that meet (i.e., the same point is the target of f and the source of g), there is exactly one arrow, the "composition" of f and g , that leads from the source of f to the target of g . This arrow is called the "composition" arrow. This composition arrow is written gf (' g follows f '). 2) Each point has an arrow called its 'identity' which is compositionally inert. That is, for any point X , there is an arrow $i: X \rightarrow X$ such that for any arrow a going into or out of X , the composition of a with i is the composition (either ia or ai) itself a . 3) For any two overlapping composition arrows gf and hg , the composition from h to gf is the same as the composition from hg to f : position from hg to f or $h(gf) = (hg)f$.

The three axioms can be summarized in a pair of intuitive rules of thumb that apply to arrow paths, i.e., to arbitrary sequences of arrows. 1.) Each path of arrows is equivalent to a single arrow. 2.) Arrow paths are indifferent to identities.

The only unshakable rule for graphs is that each arrow must go from one point to another point. In specifying a graph, the necessary and sufficient information is how many different points and how many different arrows there are in the system, and which points are connected by which arrows and in which "direction". This leaves open various degrees of freedom along which different types and instances of graphs can be determined: There may be points in the system with no arrows associated with them; there may be arrows leading from a given point back to the same point; there may be multiple arrows leading from one point to another.

Nail sees in category theory a pedetic constructivism that defines the object exclusively by its movements and relations, where future arrows are not determined by their history, but are always related to something, (source) and related to something (target). Morphisms are not random, not determined, but sui generis indeterminate. Thereby the actually the arrows are primary and not the objects. One can even omit the object and the movement of the arrows still show the structure of the relations defining the objects. Zalamea calls this an ontological fluctuation. The performative character of category theory indicates mobile boundaries between the conceptual and the material. The mathematical object becomes one with the mathematical creation. Objects are mobile and unstable and are found in contexts; they are many or multiplicities. They are therefore profoundly relational, they are the result of arrows bending back on themselves or looping, in practical inscription in a diagram. The object is therefore always a loop object or a "quasi-object" (indeterminate and relational) generated by the immanent arrow that establishes the identity. Werner Hamacher, referring to Derrida, has defined the "quasi" as follows: "This adverbial determination "quasi" is the removal of the determination of the yes in its function as the transcendental ground of all speech and even its abolition, for through the quasi the yes is on the one hand confirmed in its transcendental status, but on the other hand it is thereby

modified in such a way that it can no longer be addressed as a ground that is in itself and of itself. Since it is not present in any statement about it as this itself, the yes can only be considered as quasi-being, to which only a quasi-being is due." (Hamacher)

For Badiou, identity in category theory is not an immanent marker, but the effect of actions or arrows operating in a categorical universe. Objects are defined exclusively by their relation, or by movements in which the object is either the source or the target. An object emerges when an arrow itself becomes source and target, a kind of iterative or recursive self-function. Within these relations, the object is never fixed, but changes as the network of relations changes. As Zamalea writes, the categorical object is not something that "is" but something that is always in the process of being. In a function f , a and b are always folds in a continuous relation of f .

Nail tries to bring the kinetic operator into play again at this point, indicating that the metastable quasi-category implies that every object is infinitely composed and infinitely connected. The arrows are seen in category theory as primary and performative, but also precisely as unity. But what happens if the arrows are also indeterminate, Nail wonders. Arrows are normally the relations or morphisms that make identity possible, through looping and connecting. But the arrow a always remains a . But the identity of the arrow a must be guaranteed by another arrow a , and so on. And if one never reaches an end, one can only assume that the arrow a is equal to the arrow a .

In classical category theory, identity is defined as a product of arrows such that for every X there is an arrow $a: X \rightarrow X$, where for each arrow i which is the arrow starting from X or ending at X , the composition of i with a (ai) is i itself. However, the number of arrows leading to the identity is not determined. The kinetic operator starts at this point of infinite composition and wants to show that the so-called identity of the object is only a thin region of a more diverse world of relations. All relations in turn have relations between their relations and this up to the indeterminate. Arrows are persistent metastable mathematical actions. Thereby indeterminacy is not the same as non-identity, the former is neither x nor $\text{not } x$. It does not follow the law of the excluded third. Thus, the objects created by the arrows are also indeterminate, they are folded by looped arrows, and these arrows are composed of other arrows. The kinetic operator transforms arrows and objects into quasi-objects in a kinetic category theory.

Perhaps worth mentioning is something that does not appear at all in Nail. In category theory, Laruelle's real or one would be identical to the initial object 0 (the only category without objects and arrows).

Excursus on the notion of relation

1. relation

Relation is a paradoxical matter. The relation R , which has the poles a and b , implies firstly their connection or an inside, while secondly it separates the poles a and b , thus it sets their outside or a difference. This interaction of the mutually excluding and including dimensions of the relation generates the paradox. Either one lets the relation R become a third relatum c , or one

dissolves the relations a and b in the relation R, i.e. a and b themselves become properties of the relation R. In his dissertation of 1969 Leisegang calls variant 1 the relation of the first power and variant 2 the relation of the second power. He then connects both solutions to the relation of third power. Thereby the variants 1 and 2 lead to unsolvable aporias.

In a variant of the relation of the first power the relation itself becomes an object. One negates the multiplicity of objects and finally obtains a substance. The relation ceases to exist because it is reduced to things. This hypostasizing of R as an outside to a third entity does not lead to any meaningful result.

In another variant one injects relations into things. Here one assumes that there is something from one substance to another which connects the two substances, but at the same time this connection is supposed to be a property of the substances.

2. relation

The outside is now no longer treated as a third object, rather it is the comprehensive relation, which is extended into its poles, structuring them. Since the outside means the whole relation, i.e. relation and related, and as relation of the second power is no longer capable of any separation, because then it would be relation of the first power again with all its aporias, it is no longer possible to abstract from a reference, i.e. the reference to the recognizing subject, which makes all externality possible in the first place. Quantum physics with its observer dependence corresponds to the relation of the second power. The relation of second power, which means an inside and is no longer capable of any separation, must produce the structure of a whole, which precedes its relations.

Under the action of the relation of the second power there can be no more independent things, so that the concept of object perishes. For its defining characteristic of isolation falls, since the outside no longer permits separation, but represents a connecting inside. Under the action of the relation of second power, the subject can only perceive the moments of totality. Since the subject is embedded in the structure of the whole, it is in this structure a condition of the outside in the sense of outside itself. (Drechsel) If the hypostasis of the relation leads to aporias, related to the relation aRb only remains to reinterpret the relations themselves to relations: $a, b = R$. This is what Nail and especially also Rovelli suggest again and again, although the objects do not disappear after all. The relation of the second power does not allow any more things of the inner relation, because it does not allow any more differences, as it was still possible in the case of the relation of the first power. In this respect the relation of second power destroys its poles. Poles of the relation are only nodes of relations, yes they are relations themselves. Since every difference is leveled in the inner relation, finiteness or a thing can no longer be determined. Rovelli says yes that the properties of an object can only be determined in and as relation to other objects. Nietzsche had already written something similar. He demands an immanent, pragmatistic metaphysics of relational forces: The properties of a thing are effects on other "things": If one removes other "things", then a thing has no properties, i.e., there is no thing without other things, i.e., there is no "thing in itself".

3. relation

Thus, one cannot escape the problem of relation. Leisegang hints at it: Relation is everything that exists and everything that does not exist.

The relations of the first and second power are determined by the fact that in the one the separating and in the other the unifying moment predominates. Both types leave the respective other moment open. Unifying and separating are therefore necessary conditions of every relation. But the relation does not represent a unity of both conditions, because otherwise it would fall back into one of its aporias. The relation aRb in the sense of the relation of the third power means therefore neither unity nor separateness of the moments uniting and separating, rather it operates with the parallelism of the aporetic moments. One thinks of the quantum particle, which is neither particle (separating) nor wave (unifying).

For Leisegang the relation of third power cannot be evaded, it includes the absolute unifying and separating. The relation of third power is to be regarded as absolute for itself, since it cannot refer to itself anymore. If the relation of first power shows itself to be constituted, since it is of a posterior nature, the relation of second power as constituting, then the relation of third power must be constituting and constituted at the same time: "It is to be constituted ... by being constituted, by the 'what' of its being constituted, and at once to be dimensionally different from this 'what.'" (Leisegang)

For Leisegang, the third potency is a permanent interplay, the mutual foundationalization of the first and second potencies. According to Drechsel, he gives no indication of how its action might affect the first and second order potencies.

One might therefore ask the following questions with Drechsel:

"What effects an inside-outside on the outside?"

What is the effect of an inside-outside on the inside?

An operation of the InnenAußen on the Außen can only impart an Innen to the Außen, without it thereby becoming a pure inner reference of the 2nd power.

An operation of the inside-outside on the inside can only convey an outside to the inside without it becoming a pure outside-reference of 1st power."

Concerning the first question Drechsel writes: "The classical particles separated via the outside are aggregated via gravitation. Gravitation is nothing in particle-being. It is their inside-reference in the outside-reference! For Einstein the gravitation has wave character. There is another inside aspect in classical outside, the electromagnetic waves. Actually these are quantum objects, but the Maxwell equations, describing these waves, are now classical and not quantum. However, these waves do not aggregate the particles like gravity, they communicate with the particles instead. Accordingly, there exists in the classical context a special classical interior constituted by the operation of the relation 3rd power on the 1st power."

Regarding the second question, it can be said that an outside is implanted into the relation 2nd power, the inside, by the operation of the relation 3rd power. The Pauli exclusion principle indicates that no two elementary particles can occupy the same quantum state. Or the elementary qu-bits can contain only the information yes or no. This requires an outside in the quantum inside reference. It is here about meaningless information whose “carriers” are qubits. They have as two the maximum extension in the whole cosmos (no classical space) and contain the least information. It is a meaningless, energy-less and space-less quantum outside which acts on the classical reality. Moreover, in quantum theory, the whole is more than the sum of the parts and describes the effective power of possibilities. The concept of entanglement shows that there is a holistic total state, which includes many more states than would follow from a sum of the parts. This is due to the multiplicative composition from the subsystems. Thus, there is also an outside in the quantitative context, which is constituted by the relation 3rd power on the 2nd power. The effect of the relation 3rd power on the inside of the 2nd power consists in the imaginarieness/multiplication. This concerns the complex numbers and their imaginability.

Here, however, the problem of chiasmus or meta-difference (Laruelle) might arise. We first assign the entire relation A-B to the term B. We substitute B and, for the sake of clarity, we obtain the term A-(A-B) enclosed in parentheses. This process is endless and we arrive at the “bad infinity” of $A-B = A-(A- \dots) \dots B = B$. We get a difference or relation which is itself one of its own terms.

What happens if both terms A and B iterate? So, as before, $B = A/B$. But now also $A = A/B$. Crucially, however, A is not equal to B. Therefore, we have a “conflict about the difference between the two terms. But each of the two terms is just that difference and therefore that conflict itself. From the point of view of B, we have, as before: $A/B = A/(A/ \dots) \dots B = B$. But now from the point of view of A, we have the symmetrical but different structure: $A = (A \dots (\dots /B)/B)/B = A/B$. Combining the two, we get: $B = A/(A/(A/ \dots) \dots (\dots /B)/B)/B = A$, while B is not equal to A after all, because the difference A/B is exactly what is at stake. This is the paradoxical abstract formula of chiasmatic (meta-)difference.

For Laruelle it follows that at least philosophy cannot bear a real non-relationship (namely the real-without-syntax of the One).

translated by deepL.

Foto: Sylvia John

← PREVIOUS NEXT →

META

CONTACT

FORCE-INC/MILLE PLATEAUX

IMPRESSUM

DATENSCHUTZERKLÄRUNG

TAXONOMY

CATEGORIES

TAGS

AUTHORS

ALL INPUT

SOCIAL

FACEBOOK

INSTAGRAM

TWITTER